Disease Patterns Among Southwestern Indians

MAURICE L. SIEVERS, M.D.

SOUTHWESTERN AMERICAN Indians often differ significantly from the white population in the frequency, distribution, and manifestations of disease. Either hereditary or environmental influences may be responsible. Several aspects of these variations are discussed in this report, which includes reviews of numerous investigations conducted by others and by me. Most of the observations were made during studies at the Phoenix Public Health Service Indian Hospital during the 8-year period 1957–64. In this period, there were 14,161 admissions and 116,993 outpatient visits to this hospital. Statements which are not referenced are based upon unpublished results of my investigations.

Health Care of American Indians

In 1955, the Division of Indian Health of the Public Health Service was delegated responsibility for the health care of most American Indians and Alaskan Natives. Seven Indian health areas were established. The Phoenix area includes all Indian reservations—except those of the Navajo—which are within Arizona, California, Nevada, and Utah (fig. 1). Ten Indian hospitals, 5 Indian health centers, and 25 Indian health stations are in the Phoenix area.

The Phoenix Public Health Service Indian Hospital serves as a special referral center for all of the other Indian health facilities within the four States. The Phoenix Indian health area has an Indian population in excess of 48,000. Some Indians from other areas also are admitted to this hospital, the largest number being from the Navajo tribe. The 1957–64 tribal distribution of inpatients was as follows: Pima—35.1 percent, Apache—21.3 percent, Navajo—10.2 percent, Papago—8.0 percent, Hopi—6.3 percent, other southwestern Indians (Maricopa, Yavapai, Cocopah, Yuma, Hualapai, Chemehuevi, Mohave, Shoshone, Ute, Paiute, and Washoe)—15.9 percent, and non-southwestern Indians—3.2 percent.

The majority of southwestern Indian families have very low incomes and reside in substandard housing on isolated reservations in desert areas (fig. 2), in mountainous terrain (fig. 3), or within canyons (frontispiece). In addition, ritualistic healing practices persist in many tribes. The Indian medicine man may become a strong ally, however, in motivating the tribal acceptance of modern medical practices if physicians and other workers exhibit an understanding, cooperative attitude toward the established Indian customs (fig. 4).

Disease Patterns

The various studies included in this report were primarily prospective, based on clinical evaluations, laboratory and X-ray examinations, and autopsy observations. Although some tribal variations in the occurrence of a few conditions are stressed, most of the comments concern the differences between the southwestern Indians and the general population in disease distribution. These observations are presented by disease category.

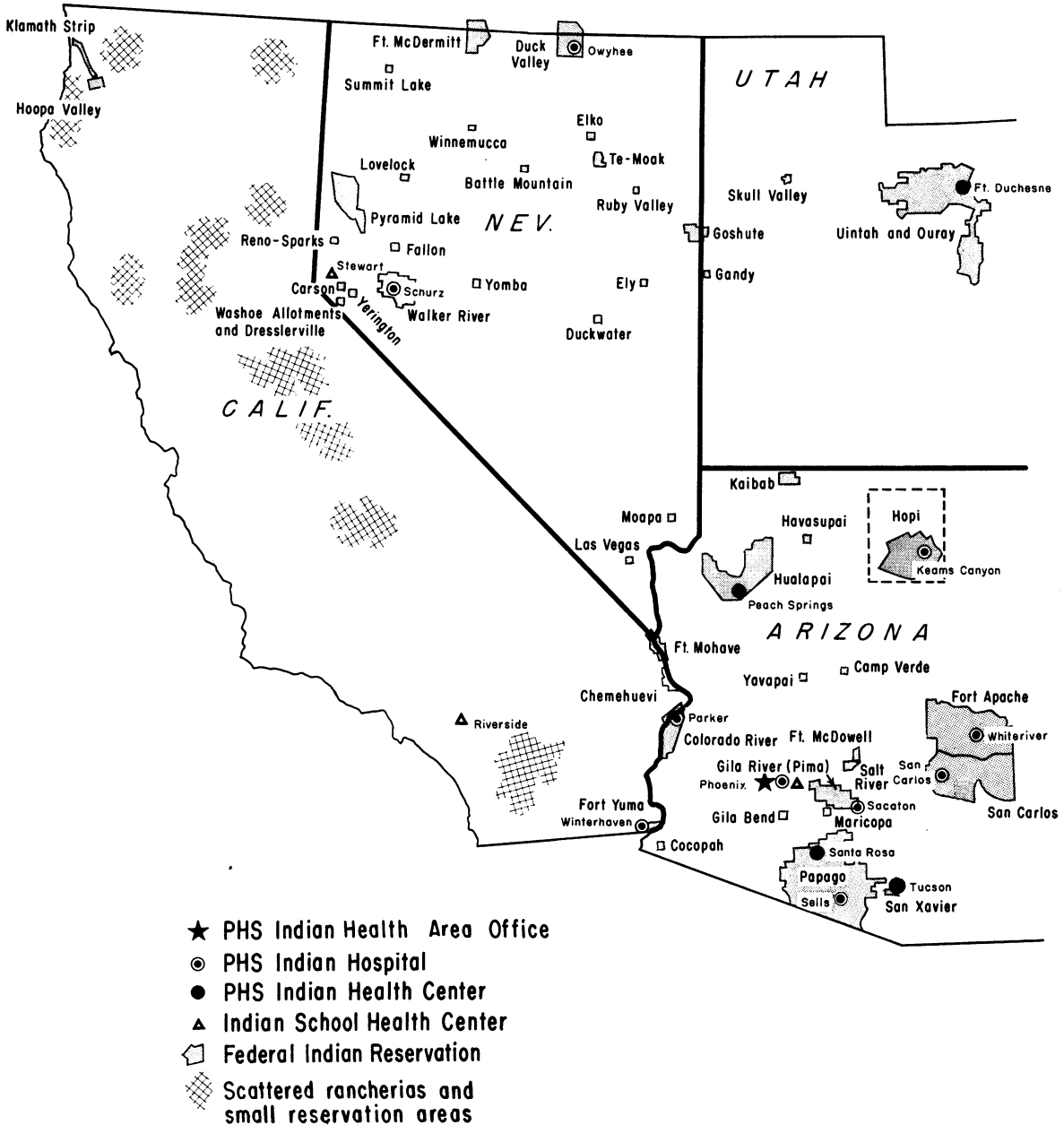
Duodenal ulcer. In an 8-year study of gas-

Dr. Sievers is chief of the department of medicine, Public Health Service Indian Hospital, Phoenix, Ariz. *This paper was presented on September 15, 1965, at the Phoenix area medical officers orientation conference.*

tric secretory diseases, only three Indians were discovered with duodenal ulcer, and all three were from nonsouthwestern tribes (*1*). Gastrointestinal X–ray examinations were performed on southwestern Indian patients who had symptoms suggesting possible gastrointestinal dysfunction (fig. 5). Gastric cancer was found in 19 patients, pernicious anemia in 6, and benign gastric ulcer in 5. Laparotomy for acute abdominal disease was performed on 554 patients, but there was no evidence of duodenal ulcer. Although each of the common complications of duodenal ulcer—intestinal perforation, obstruction, or hemorrhage—occurred, all were due to other causes than duodenal ulcer.

Study of autopsy reports revealed 10 deaths

Figure 1. Federal Indian reservations and health facilities in the Phoenix area (Arizona, California, Nevada, and Utah)



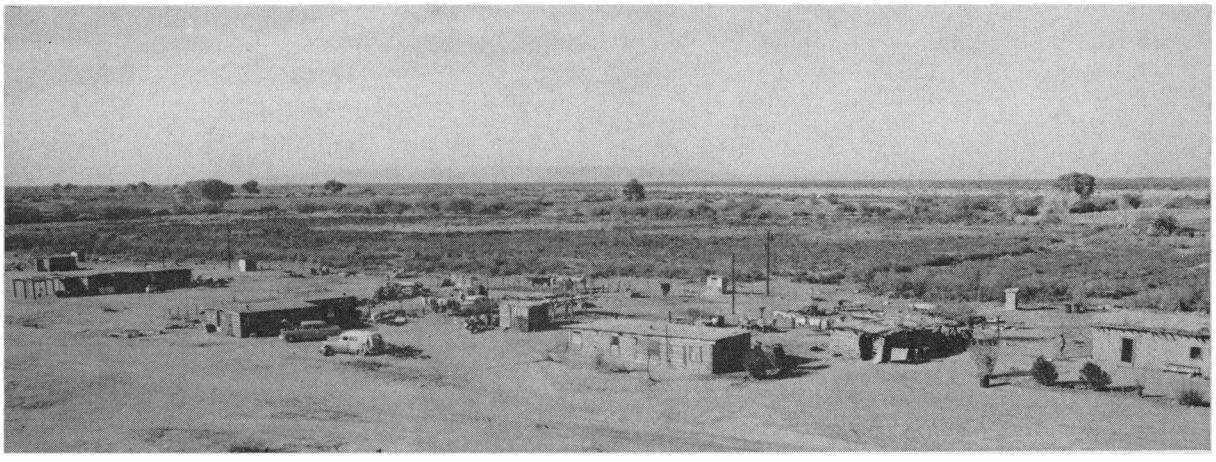


Figure 2. A Pima Reservation Indian community in an isolated desert area. The adobe dwellings—"sandwich houses"—are typical for this tribe

from massive gastrointestinal hemorrhage; portal cirrhosis was present in 8 of these patients, while the other 2 evidenced trauma and azotemia. Healed gastric ulcer was found in 1 of 194 postmortem examinations of adults; no evidence of duodenal ulcer was noted. In contrast, approximately 10 percent of the white population have signs of peptic ulcer at necropsy.

Both hereditary and environmental influences may relate to the deficit of duodenal ulcer among the Indians of the Southwest. To explore these possibilities further, I conducted a study of gastric secretory function among 982 southwestern Indians (*2*). An increased incidence of achlorhydria was noted compared with that for white persons, but not compared with that for Negroes. Comparison of these results with other published studies for the white population also suggested that achlorhydria occurs more frequently among the Indians. There was no evidence that ethnic tribal origin, diabetes mellitus, or ABO blood groups—all reflections of heredity—were related to the increased frequency of achlorhydria among Indians of the Southwest. Environmental factors such as dietary insufficiency and alcoholic ingestion may contribute to gastric secretory dysfunction. An excess of achlorhydria may be one of the basic reasons for the infrequency of duodenal ulcer among these Indians. Further investigation is needed, however, to delineate other possible factors which protect southwestern Indians from developing duodenal ulcer.

Biliary disease. The incidence of gallbladder disease in most Indian tribes exceeds the rate in the white population. Data supporting that conclusion have been presented previously for the Sioux (*3*), the Navajo (*4*), and Pima (*5*) tribes. Hesse (*5*) estimated that 2.3 percent of the Pima Indians over 15 years old are hospitalized each year for cholecystitis. In a recent study (*6*) we did at the Phoenix Public Health Service Indian Hospital, 32 percent of the adult Indians had gallstones at autopsy, in contrast with a reported occurrence of 6 percent among white persons (*7*). During the 8-year study period 1954–61, 414 patients had cholecystectomies performed, while only 115 had surgery for acute appendicitis (*6*). Cholelithiasis occurs more often in the Indians at a younger age than in the white population. The female-to-male ratio for occurrence of the disease is approximately 7 to 1 for southwestern tribes (*5, 6*) and 3 to 1 for white persons (*7*). About 2 percent of the Indians with biliary calculi also have carcinoma of the gallbladder. Kirshbaum and Kozell found malignancies in 3 percent of the general U.S. population with calculous gallbladders (*8*).

Since peptic ulcer is uncommon among southwestern Indians, most severe gastrointestinal symptoms are due to cholecystitis, and laparotomy is performed most often for biliary disease. Early and frequent childbearing, recurrent enteric infections, and obesity may relate to the high frequency of pathologic gallbladder among Indians. Since tribes differ in the prev-

alence of obesity, a comparative study of tribal incidence of cholelithiasis is desirable. Although 90 percent of gallstones are comprised of cholesterol (*9*), the relationship of steroid metabolism to biliary calculi is obscure. Study results vary, but most authors suggest that southwestern Indians have blood cholesterol levels similar to (*10*), or somewhat lower (reference 11 and unpublished data of mine for 1965) than those of white people.

Hepatic disease. Dietary deficiencies and alcoholism are frequent on most reservations and probably contribute to the prevalence of portal cirrhosis. Sporadic epidemics of infectious hepatitis also occur, perhaps as a result of deficiencies in sanitation and water supply. Fatty liver is a common postmortem observation. Laennec's cirrhosis occurs more often at a younger age and more frequently among females than it does in the white population. Esophageal varices are overwhelmingly the most frequent cause of major gastrointestinal bleeding in the Indian population.

Diabetes mellitus. Among American Indians, the prevalence of diabetes mellitus varies considerably, but it is far more frequent in the southwestern tribes whose members tend to be obese than in the general U.S. population. In 1954, Kraus (*12*) estimated that diabetes was least frequent in the Navajo and Apache tribes and most frequent in the Papago and Pima tribes. Among adult patients admitted to the medical service of the Phoenix Public Health Service Indian Hospital, 26 percent are diabetic (males—21 percent and females—30 percent). Major tribal rates are as follows: Pima—45 percent, Colorado River tribes—33 percent, Papago—32 percent, Hualapai and Supai—28 percent, Colorado River tribes—33 percent, Hopi—9 percent, Apache—7 percent, and Navajo—about 1 percent.

In a 1963 survey of 85 percent of the Pima

Figure 3. Contrast in types of housing on Whiteriver Apache Reservation. These mountain-dwelling Indians continue to use extensively the traditional wickiup, shown in the foreground

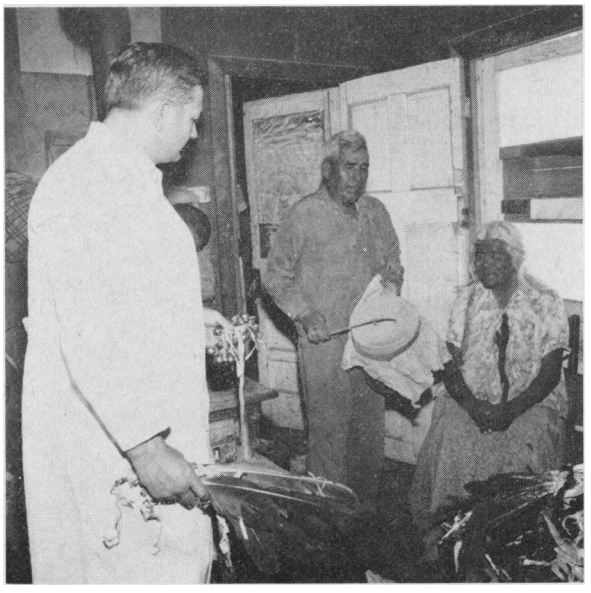


Figure 4. An Apache Indian medicine man with drum performing a traditional ceremony for an ill Indian woman while a Public Health Service Indian Health physician, maintaining a respectful attitude, holds bells and feathers

Indians of the Sacaton Service Unit, Division of Indian Health, who were over 30 years old, postprandial hyperglycemia was reported among 31.3 percent—25.7 percent of the males and 36.4 percent of the females (personal communication from Dr. W. L. Nash, now director of the Indian Health Service Unit, Public Health Service Indian Hospital, Cherokee, N.C., and Dr. S. O. Foster, department of medicine, San Francisco Medical Center, San Francisco, Calif., dated May 16, 1963). A subsequent study (*13*) revealed that 49 percent of the Pimas over 30 years of age had true blood sugar levels greater than 160 mg. per 100 cc. 2 hours after ingestion of 75 grams of glucose. These observations suggest that the incidence of diabetes mellitus among the Pimas—one of the highest ever reported—is about 15 times that for the general population.

Characteristically, diabetes mellitus is the fairly stable "adult" type. A very high blood sugar level is apparently a less ominous finding in southwestern Indians than in white people, as acidosis is infrequent among them, and no deaths directly attributable to diabetic coma have been encountered. An elevated renal threshold for glucose is common enough in these Indians that tests for glycosuria are of limited usefulness for diabetes detection or for assessing treatment results.

One of the bizarre observations about Indians with diabetes mellitus who develop gangrene in a lower extremity is that bounding pedal pulses are present in most cases. Presumably these persist because only the more distal arterioles are seriously involved.

Enteric infections. Diarrhea and gastroenteritis have been a major cause of Indian infant mortality and adult morbidity. A bacterial origin is common. Typhoid fever, salmonellosis, shigellosis, and amebiasis are not unusual, and the specific diagnosis needs to be sought in every appropriate situation. Typhoid carriers are occasionally discovered on some reservations. Deaths from fulminant amebiasis still occur.

Tuberculosis and coccidioidomycosis. Tuberculosis continues to plague the southwestern Indians far more than the general population. The presence of the disease, however, is sometimes inapparent. In particular, extrapulmonary tuberculosis often has the unrecognized capacity to mimic other diseases. Therefore I have suggested that tuberculosis be referred to as "the second great imitator" (*14*) and be given foremost consideration as the cause of obscure illness in Indians.

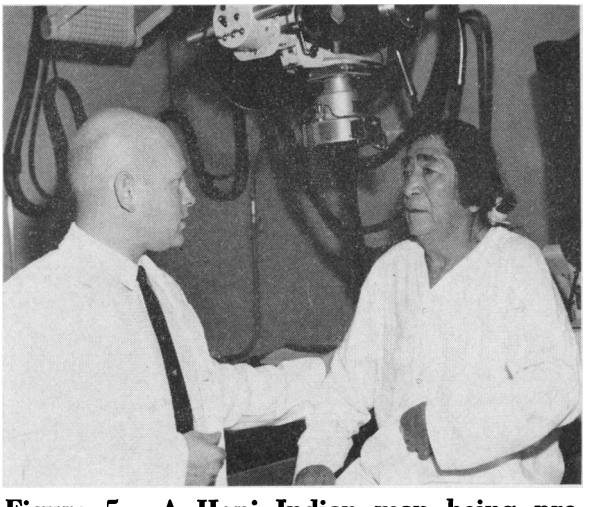


Figure 5. A Hopi Indian man being prepared by the radiologist of the Phoenix Public Health Service Indian Hospital for gastrointestinal X-ray examination

Coccidioidomycosis infection originates in the Lower Sonoran life zone (*15*), a biogeographic area which is comprised of the most southerly portions of the arid areas of the western United States and central Mexico. Therefore, only those reservation Indians residing in these limited regions (the various Colorado River tribes and the Pimas, Papagos, and San Carlos Apaches) or Indians who visit these areas develop the disease (*16*). Direct transmission from an infected human being does not occur; only spore-bearing dust is a source of infection (*17*). The regions where *Coccidioides immitis* inhabits the soil closely approximate the area where the creosote bush flourishes, as stressed by Maddy (*15*). In my recent study of southwestern tribes (*16*), the San Carlos Apache reservation had the highest rate of coccidioidin skin reactivity and the greatest frequency of disseminated coccidioidomycosis.

Primary glaucoma and trachoma. Primary open-angle glaucoma is probably the most frequent cause of blindness in white adults. Several ophthalmologists, however, who have had extensive experience with southwestern Indians report that they have never seen this condition among them (personal communications to author from Dr. Phillips Thygeson, clinical professor of ophthalmology, University of California School of Medicine, San Francisco, Calif., and Dr. R. O. Schultz, department of ophthalmology, Marquette University School of Medicine, Milwaukee, Wis., dated February 8, 1963; from Dr. D. K. Powers, area consultant to the Phoenix Indian Health Area Office, and Dr. S. Davidson of Phoenix, dated September 11, 1964). The explanation for the deficit of glaucoma is obscure, but further study is proposed.

Trachoma has become rare in the white population of the United States, but it continues to occur in members of all southwestern Indian tribes at all ages. It is a major cause of entropion, irreversible blindness, and significant ocular disability in Indians. Preventive programs are underway (fig. 6).

Malignancy. Despite the widespread opinion that Indians seldom develop cancer, few valid data have been assembled on cancer among Indians. A recent analysis of autopsy data revealed no age-adjusted deficit of malignant disease among southwestern American Indians, although distribution of malignancy by organ site differed significantly from that of the general population (personal communication from Dr. D. D. Reichenbach, department of pathology, University of Washington, Seattle, May 26, 1965). These data confirm an earlier study of mine at the Phoenix Public Health Service Indian Hospital (*18*), which revealed a striking absence of bronchogenic cancer. Whether heredity or environment contributes to this deficit is uncertain. The air of Indian reservations, however, is not contaminated by industrial fumes, and Indians smoke infrequently and seldom extensively.

Gastric cancer is the malignancy most often encountered among the southwestern Indians (*1*, *6*, *18*). A possible increased incidence of achlorhydria over that of the white population (*2*) may be pertinent. The significant frequency of cervical carcinoma (*1*, *6*, *18*) among southwestern Indian women may relate to their high rate of childbearing and to deficiencies in the hygiene of the male and female genitals. The marked prevalence of gallstones among these Indians may have an etiological relationship (*8*) to an apparently greatly increased rate of malignancy of the gallbladder and bile duct as compared with the rate for the white population (*6*), although this association is not universally accepted (*19*).

There is a relative deficit of breast cancer (*1*, *6*, *18*) among southwestern Indians. Smith and associates (*20*) also noted this deficit in their study of death certificates of Navajos. Among white women, the breast is the site of most malignancies (*21*). The lower rate of breast cancer in these Indians may relate to factors known to be associated with decreased incidence—gestation, lactation, and multiparity (*21*)—all of which are more frequent in Indian women than in white.

Atherosclerosis and hypertension. Atherosclerosis among southwestern Indians is less frequent than in the white population (*4*, *5*, *11*, *22*, *23*). Some evidence (reference 11 and unpublished data of mine for 1965) suggests that southwestern Indians also have lower blood cholesterol levels than the white population.

Figure 6. Examination and treatment for trachoma often requires the Public Health Service Indian Health physician to visit Indian homes such as this one in the community of Bylas on the San Carlos Apache Reservation

Although many have suspected that atherosclerosis is related to diet, these Indians use lard almost exclusively and seldom consume unsaturated fats (*5*). Coronary heart disease does occur occasionally, although angina pectoris is very infrequent. Over a 10-year period (fiscal years 1957–66), an autopsy or electrocardiographic diagnosis of myocardial infarction was established for 138 Indians, but only 56 of these had a history of an acute infarction. Most coronary thrombosis or severe atherosclerosis among the southwestern Indians is associated with well-known precipitating causes such as diabetes mellitus or high blood pressure.

Hypertension, however, is relatively infrequent in most southwestern Indian tribes except, perhaps, in the Apache (*23*, *24*). Malignant hypertension is a rarity, no cases having been seen in the Phoenix Public Health Service Indian Hospital during an 8-year period.

Skeletal fluorosis. In certain areas, including various regions of the Apache, Papago, Hopi, and Colorado River reservations, the sole water supply has an elevated fluoride con-

tent (*25*). X-ray studies of adults from these regions occasionally show increased density of bones. Skeletal fluorosis is responsible for this development, as chemical analysis has substantiated. X-ray results frequently present diagnostic difficulties to physicians unfamiliar with the specific cause of the bone density. Clinicians have considered and investigated diagnoses varying from osteopetrosis to osteoblastic metastatic carcinoma. Skeletal fluorosis is apparently a benign condition (*25*) requiring recognition but no further diagnostic or therapeutic measures.

Blood groups and erythroblastosis. About 45 percent of the white population have blood group O, and 40 percent have blood group A (*26*). Southwestern Indians average 83 percent with group O and 17 percent with group A (*1*). Only the Apache (*1, 27*) and Navajo (*1*) tribes have a larger representation of blood group A. Although the blood of 15 percent of the white population is Rh negative (*1*), apparently 100 percent of southwestern Indians are Rh positive, the rare Rh negative blood invariably being found in persons of mixed races. Therefore fetal erythroblastosis due to Rh incompatibility is neither expected nor observed among southwestern American Indians.

Miscellaneous threats to health. Trauma is a constant threat to reservation Indians. Subdural hematomas are common in infants, and fractures are frequent at all ages. The underlying causes include automobile accidents, alcoholism, and the occupational riding of horses.

Cannon (*28*) noted that umbilical hernia was considerably more frequent than inguinal hernia among southwestern Indians, in contrast to the experience of the white population. The explanation for this difference is unknown.

A recent survey of Pima Indians (*29*) revealed an unexpected prevalence of rheumatoid arthritis. Clinical evidence from many reservation hospitals also suggests a high occurrence rate among most southwestern tribes.

In 1964, Herxheimer (*30*) discovered only a small number of cases of bronchial asthma among various southwestern Indian tribes. The incidence he found was much less than for the white population. This result substantiates previous opinion.

Congenital lesions occur frequently in many tribes. Albinism, polydactylism, hemorrhagic telangiectasia, congenital heart disease, and dysplasia of the hip are often encountered. One contributing factor may be the tendency for marriages to be confined to the tribe, so that spouses are often closely related. Further study of some of these conditions is proposed or in progress.

Summary

Among southwestern Indians, duodenal ulcer is rare, but cholelithiasis is prevalent, accounting for most laparotomies. Diabetes mellitus occurs frequently, especially in tribes whose members tend to be obese. Gastric and biliary cancer are the leading types of malignancy among southwestern Indians. Breast and lung carcinoma are less frequent than among white people. The infrequency of atherosclerosis may reflect low blood cholesterol levels. Myocardial infarction seldom occurs in these Indians without diabetes, hypertension, or other definite precipitating factors. Hypertension is apparently less frequent than among white persons.

A high rate of tuberculosis persists among southwestern Indians, and this "second great imitator" must always be considered in any obscure illness among them. Coccidioidomycosis occurs only in Indians who reside within, or visit, the area where *Coccidioides immitis* infests the soil. Skeletal fluorosis due to a high fluoride content of drinking water has been noted in Indians in certain southwestern reservation areas and requires recognition but no other diagnostic or therapeutic procedures. For unknown reasons, Indians apparently do not develop primary open-angle glaucoma, but trachoma is a common ocular disease. Since the Rh negative blood type probably does not exist among southwestern Indians, erythroblastosis fetalis due to Rh incompatibility is neither expected nor observed. Alcoholism, dietary deficiency, Laennec's cirrhosis, and bleeding esophogeal varices are major health problems of most tribes.

The high rate of traumatic lesions among southwestern Indians may relate to alcoholism, automobile accidents, and the occupational rid-

ing of horses. Umbilical hernia has been noted much more often than inguinal hernia. Rheumatoid arthritis is fairly prevalent. Bronchial asthma is infrequent. A significant number of congenital lesions occur, perhaps because of the frequent consanguineous marriages in many southwestern American Indian tribes.

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Reorganization of the Public Health Service

THE NEW ORGANIZATION of the Public Health Service has been approved by Secretary John W. Gardner of the Department of Health, Education, and Welfare and is expected to go into effect about January 1, 1967, when necessary administrative changes related to funds, personnel, and delegations of authority are completed. The new plan replaces the structure with three operating bureaus which has been in effect since 1944.

The Secretary, who previously approved an overall five-bureau structure for the Service based on a 1-year study by experts within and outside Federal Government, has accepted a more detailed plan prepared by Surgeon General William H. Stewart assigning the existing and new divisions within five bureaus.

Following is a list of the five bureaus and their newly assigned divisions.

1. THE BUREAU OF HEALTH SERVICES combines the direct medical care programs of the Service with its activities related to the development of health facilities and the delivery of community health services.

Division of Direct Health Services
Division of Health Mobilization
Division of Hospital and Medical Facilities
Division of Medical Care Administration
Division of Community Health Services
Division of Federal Employee Occupational Health and Safety
Division of Indian Health
Division of Mental Retardation

2. THE BUREAU OF HEALTH MANPOWER brings together programs of support for the education and training of urgently needed health professionals and supporting personnel.

Division of Physician Manpower
Division of Allied Health Professions Manpower
Division of Nursing
Division of Dental Health

3. THE BUREAU OF DISEASE PREVENTION AND ENVIRONMENTAL CONTROL combines Public Health Service activities in the control of communicable and chronic diseases, injuries resulting from accidents, and hazards of the modern environment.

National Center for Radiological Health
National Center for Urban and Industrial Health
National Center for Chronic Disease Control
National Center for Air Pollution Control
National Communicable Disease Center

4. THE NATIONAL INSTITUTE OF MENTAL HEALTH has been made a bureau to provide a strong central resource for research and community services designed to conquer mental illness.

Division of Extramural Research Programs
Division of Manpower and Training Programs
Division of Mental Health Service Programs
Division of Special Mental Health Programs
Division of Field Investigations

The Mental Health Intramural Research Program includes the Division of Clinical, Behavioral, and Biological Research Programs and the Division of Special Mental Health Research Programs.

5. THE NATIONAL INSTITUTES OF HEALTH, the primary biomedical research arm of the Federal Government, is augmented by the addition of a new Division of Environmental Health Sciences to spearhead research on environmental threats to health.

National Institute of Allergy and Infectious Diseases
National Institute of Arthritis and Metabolic Diseases
National Cancer Institute
National Institute of Child Health and Human Development
National Institute of Dental Research
National Institute of General Medical Sciences
National Heart Institute
National Institute of Neurological Diseases and Blindness
Division of Biologics Standards
Division of Research Facilities and Resources
Division of Research Grants
Division of Regional Medical Programs
Division of Research Services
Division of Computer Research and Technology
Division of Environmental Health Sciences
Clinical Center

To coordinate and direct these programs and set overall policy for the Public Health Service, the Office of the Surgeon General will be strengthened and expanded. Following are its components.

Office of Legislation
Office of Program Planning and Evaluation
Office of Extramural Programs
Office of Administrative Management
Office of Personnel
Office of Information
Office of International Health
Office of Equal Health Opportunity

The National Library of Medicine and the National Center for Health Statistics are directly related to the Office of the Surgeon General but have independent status.